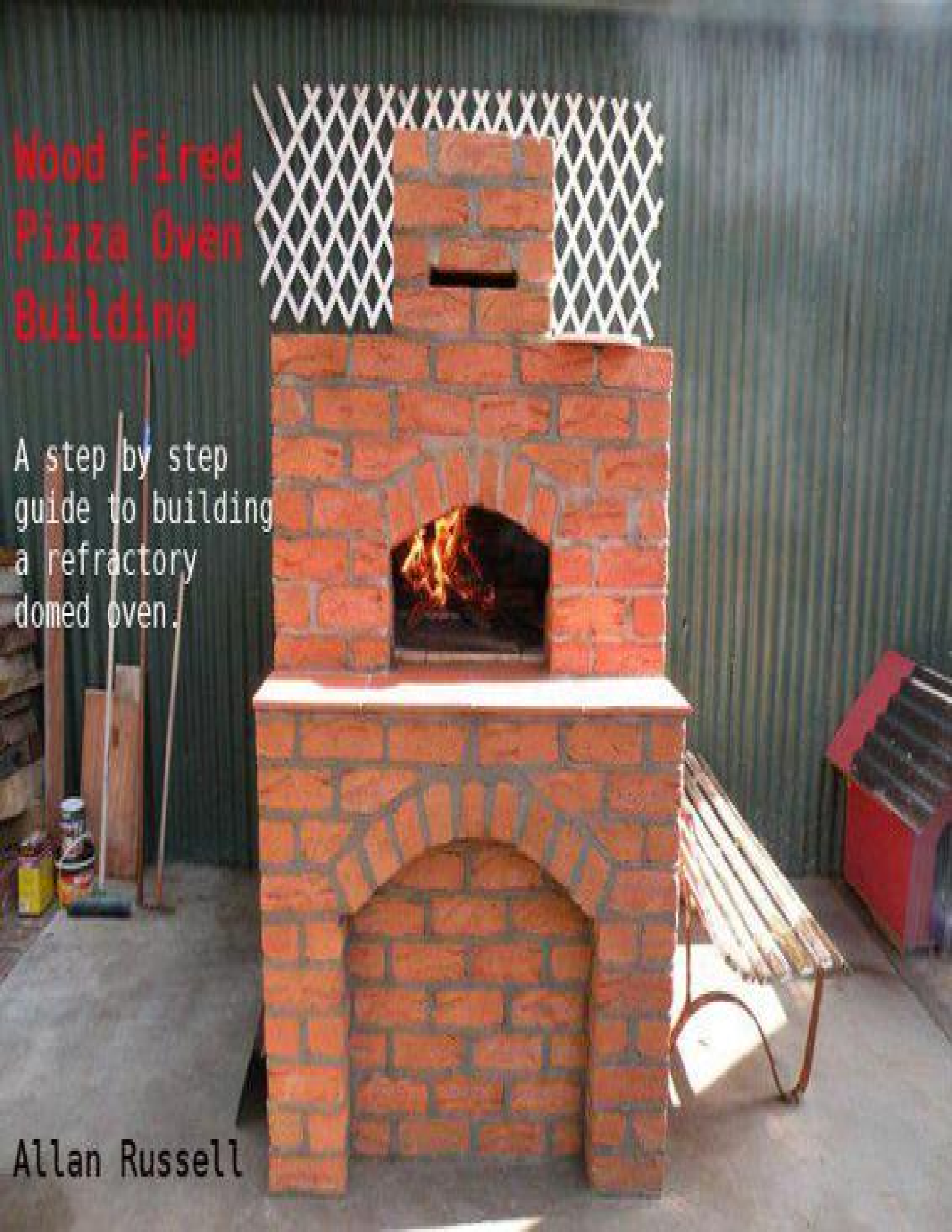
Wood Fired Pizza Oven Building

A step by step guide to building a refractory domed oven.

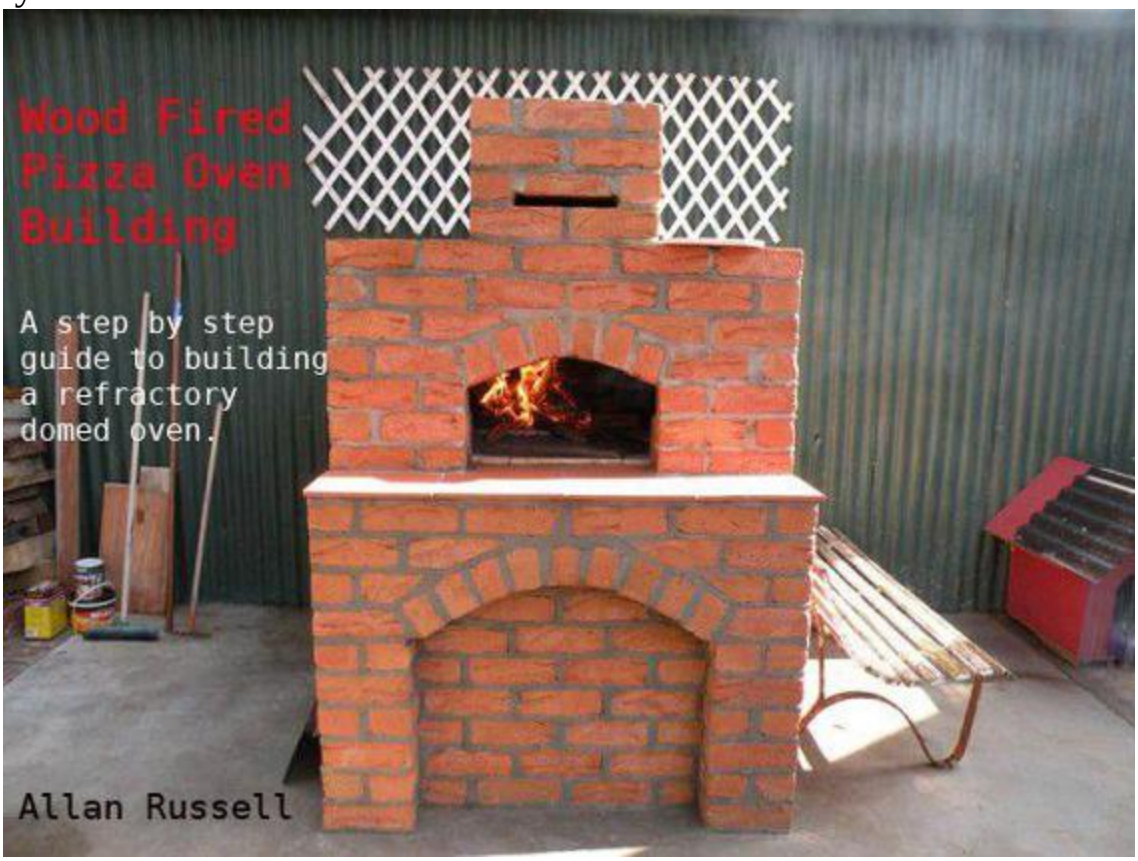


Allan Russell

Wood Fired Pizza Oven Building.

Cast refractory concrete type.

By Allan Russell.



Why build a wood fired oven?

It seems that everyone is going back to the traditional way of cooking food with a wood fired oven. Wood fired ovens need lots more time and attention to cook with, but you and your friends will be well rewarded with great tasting food. If the food requires heat to cook then a wood fired oven can do it, pizzas, roasts, bread, stews and can also be used on the cooling cycle for drying herbs, fruit, jerky etc.

What makes Wood Fired Ovens work?

The basics.

Below are some basics requirements on what make a wood fired oven work. The same principals apply to all ovens no matter what type you plan to build, be it a castable refractory concrete, brick or a clay oven.

In this book I will guide you through the building of a cast refractory concrete type oven.

Thermal mass.

With good thermal mass, ie, bricks and refractory concrete (normal Portland cement concrete is unsuitable) the oven will stay hot for days on end.
The more thermal mass the oven has the longer the oven will stay hot, the trade off is that the more mass you have the more time and fuel it will take to get the oven to temperature.

Good thermal mass properties can be achieved with as little as 75mm of refractories.

Insulation.

Good insulation is required to keep the heat stored in the bricks from escaping to the atmosphere and cooling down. Ceramic blanket, calcium silicate board, insulating fire bricks and vermiculite are the main readily available insulating materials.

Contrary to popular belief, sand and broken glass are not good materials for using as a thermal insulator, it would just add more to thermal mass.

Insulation must be under the oven hearth floor and all around the top and sides of the oven to be effective.

Flue.

The minimum size for a flue or chimney internal measurement shouldn't be less than 10% of the oven opening size, a larger flue than 10% is always better to allow the hot gases to escape via the flue rather that from the oven opening.

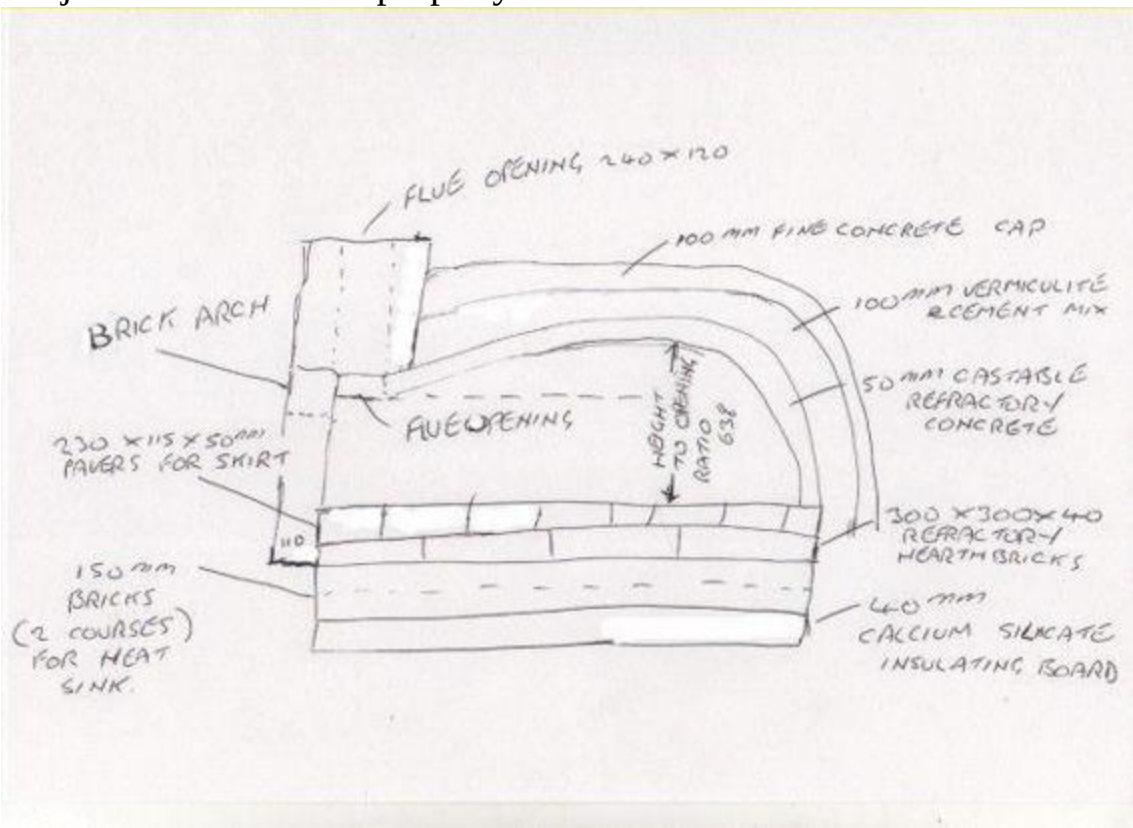
Ovens can be built without a flue but it is far better if a flue is incorporated in the build so you don't have to suffer from the smoke or hot gases escaping out of the oven opening as you try to cook.

The Golden Ratio.

Also know as the Golden Mean, Golden Rule or the Fibonacci Rule is 63%.

The golden ratio applies to all manner of buildings and constructions to assure they look symmetrical and pleasing to the eye, it also applies to an oven to make sure it draws properly.

In building the oven the top of dome to top of door height ratio is 63%, this will ensure that the fire draws properly and you don't end up with a lazy fire that just refuses to burn properly.



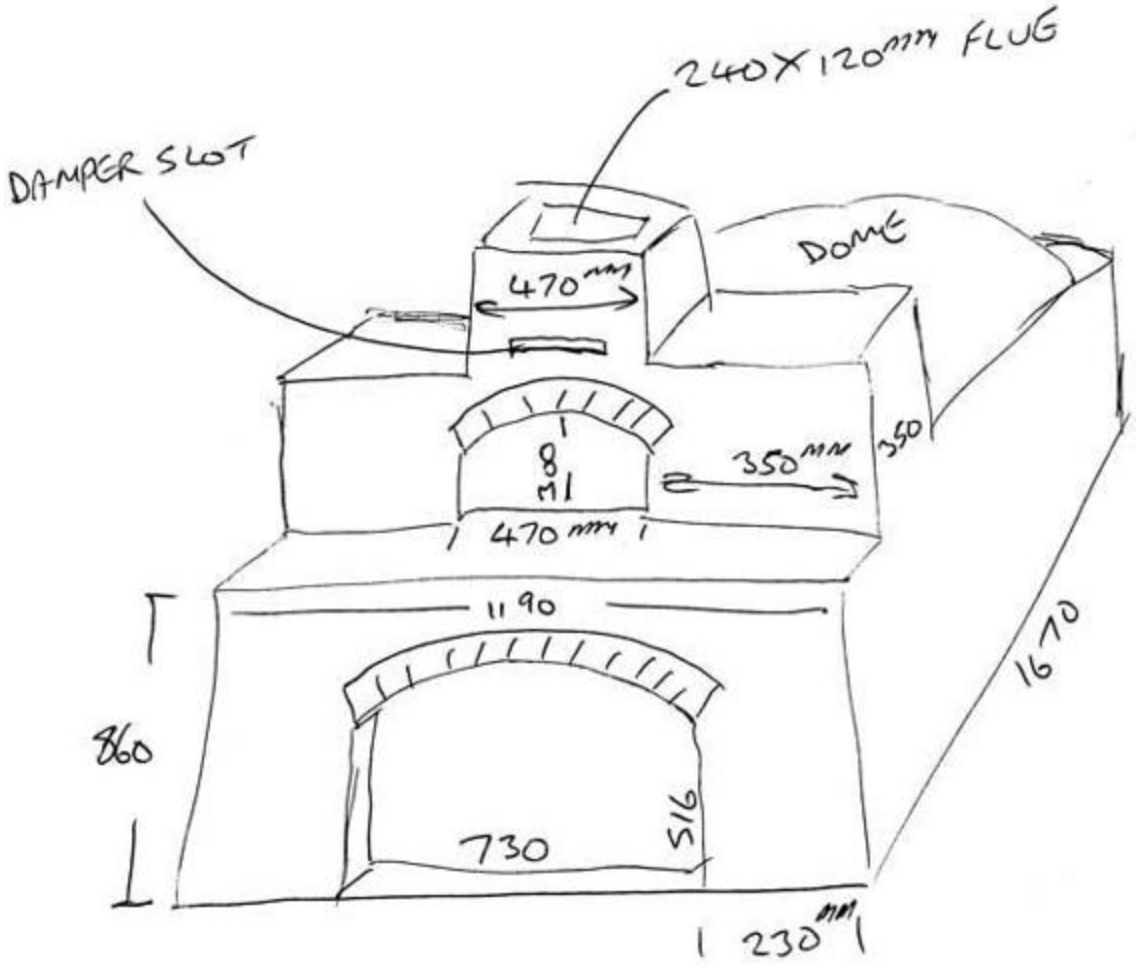
You can see in this rough sketch when the oven was in the design stage, that the door opening to ceiling of oven maintains the 63% ratio.

This oven needs some basic DIY skills and tools to complete.

Oven Design.

Rough sketch.

The main design criteria for my oven was for a particular door opening size I wanted, the door size will allow large pans to be put into the oven.
The height of the door determined the height of the interior of the oven.
As I used bricks for the oven base I dry set out the oven before I actually build it, it always pays to do this just makes sure that everything is going to fit together nicely.



Rough sketch of how I wanted the oven to look.

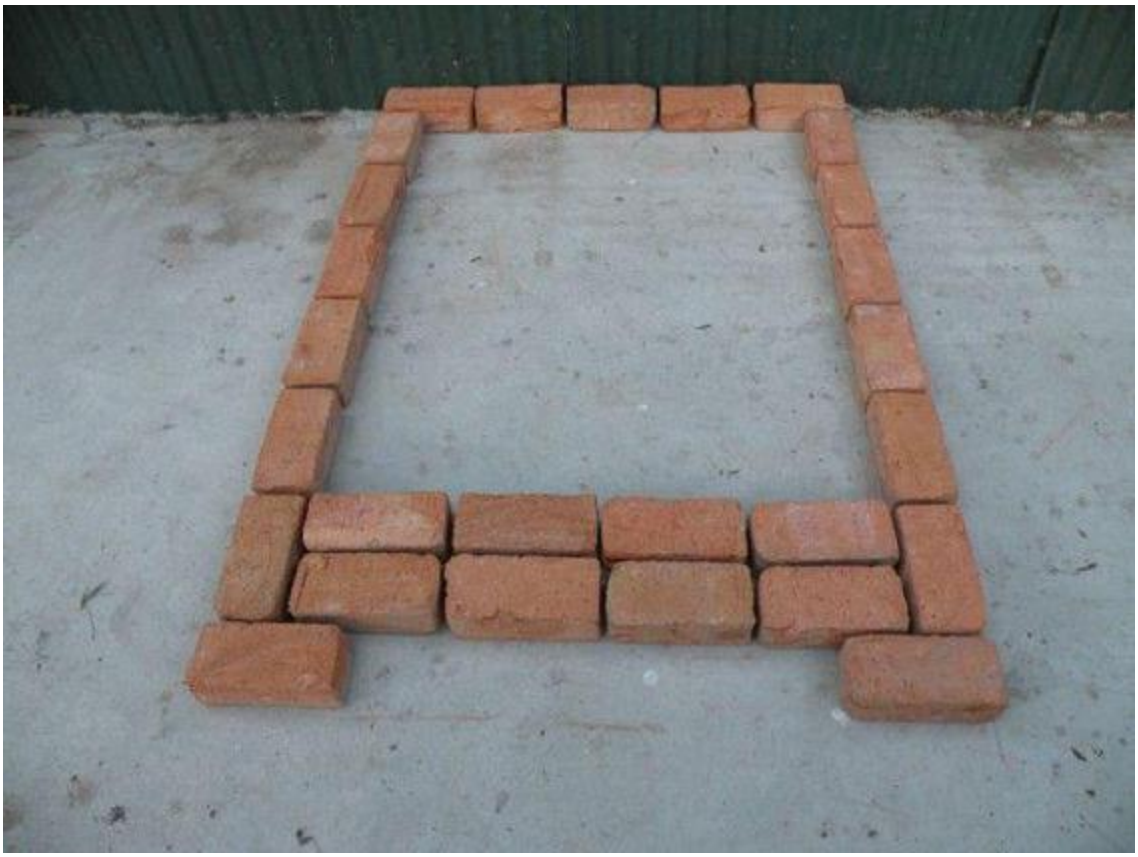
Sizing.

As with thermal mass there is a trade off with the size of the oven, the bigger the oven the more fuel and time it will take to get to temperature, but a larger oven will allow you more flexibility inside the oven for fire and food placement.

Setting out the oven.

Once you have designed the oven its best to dry set it out, this is just to make sure that everything is going to fit together nicely. Its much easier to make adjustments if the bricks are laid dry first.

Oven chamber and brick base set out dry.



Oven chamber and brick base set out dry.

Concrete Slab.

If starting from scratch you will need a concrete foundation for the oven to sit on.
You will need to dig out a pad that is 200mm bigger than the length and width of your oven, (which you have already dry set out to determine the size) the slab needs to be around 100mm thick concrete plus some reinforcing steel.
If the concrete slab is built on fairly solid ground then there is very little prep work that needs doing apart from removing any vegetation.

A timber box will need to be built to retain the concrete until it sets.
On less stable ground you may need to put in some crushed rock and compact it before pouring the slab.
Your local conditions will also have to be taken into consideration too with the slab construction.
I already had a concrete base so I just used that to build the oven on.

Oven Base.

This is where your oven will sit so the base has to be of sturdy construction as you don't want the oven to move once finished. You have already dry set out the base and taken pictures and measurements so you can now replicate it here**.**

This base was constructed with bricks but concrete block would do the job just as well.
Blocks would be easier to lay and can be rendered or bagged to finish it off. You can dry stack core fill blocks and fill the cores with concrete.

The base brickwork measures 1190mm x 1670mm and is 860mm high when finished, this gives a hearth height of 900mm, hearth height is a personal thing, make the hearth height that suits you.

Bringing up the brick base

Brick piers were built inside the base to take a waterproof plywood sheet, the base could have also been filled with sand, soil or rubble, on top of the plywood sheet sits 100mm of concrete on which the hearth sits.

Arches give an extra feature to the oven but can be avoided if not wanted.

The completed base ready to take the oven hearth.

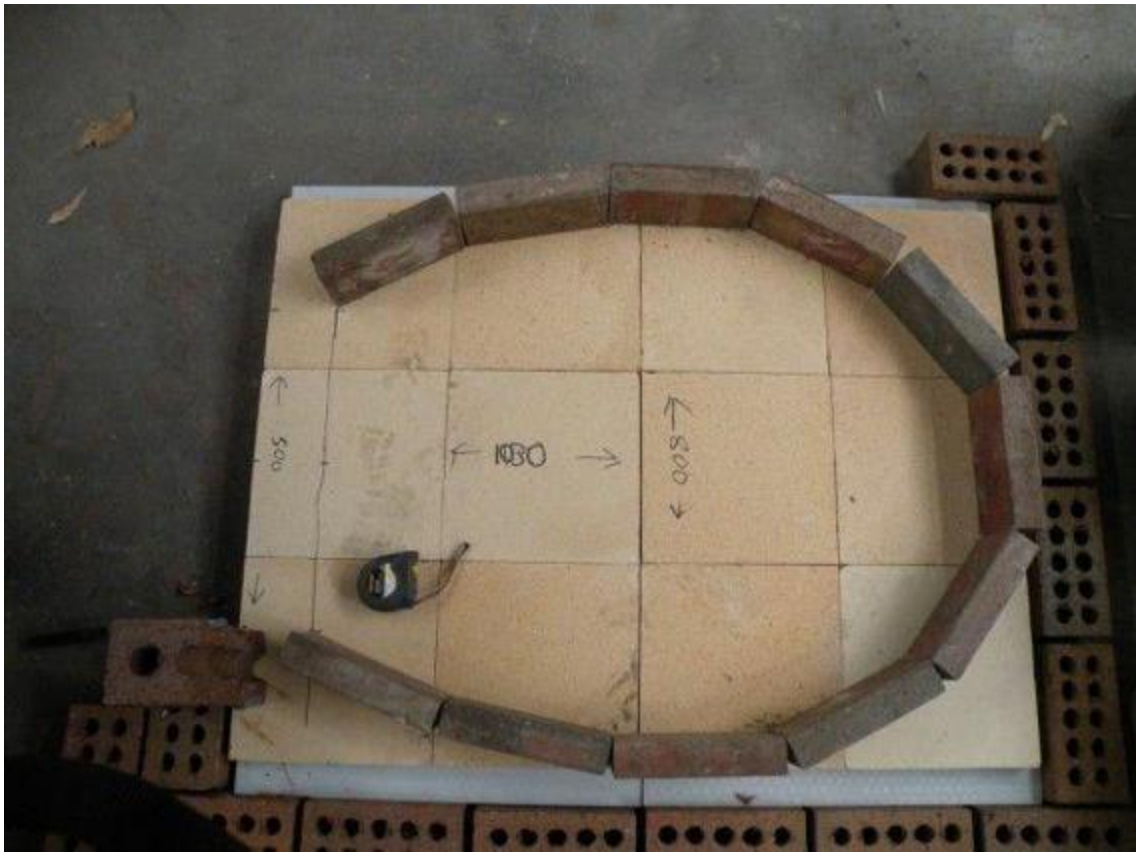
Hearth.

Oven hearths are generally made from refractory fire bricks, or as in this case fire tiles, normal pressed red house bricks can also be used.

The oven size can be seen written on the tiles, 800mm wide x 1030mm deep, door opening will be 500mm.

The clay pavers around the edge of the oven act as a skirt and lift the refractory concrete up a little off the oven floor, this adds a bit of height to the oven and also helps in stoping the refractory concrete from getting damaged.

Only clay pavers should be used as normal concrete pavers are unsuitable.



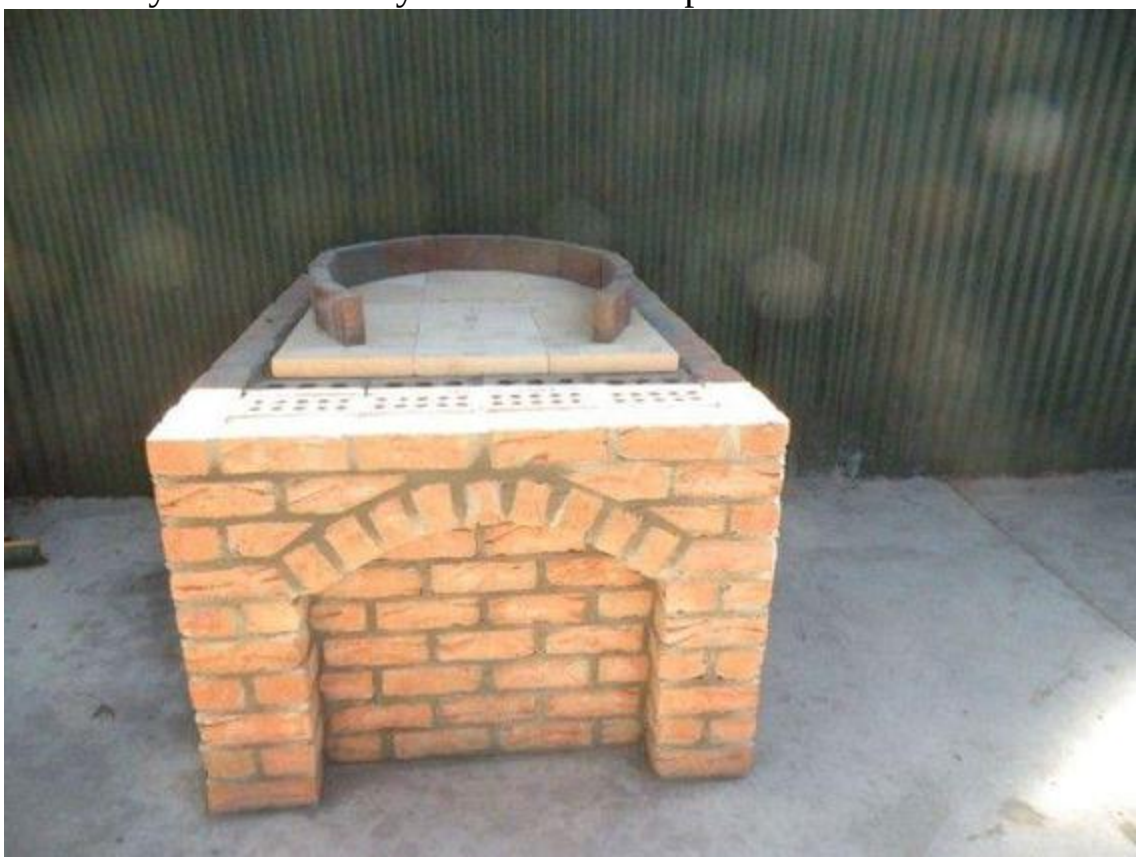
Hearth set out with skirt.

Underneath the hearth tiles two layers of normal house bricks were laid dry to increase the thermal mass, so there is 190mm of thermal mass in total for the oven floor.

This all sits on the 40mm calcium silicate board, (seen under the tiles in the picture above) the board will stop the heat from leaking out downwards via the base..

The clay pavers forming the skirt were glued in place with air dry refractory glue, after the glue had set, fine concrete was put on the outside of them to reinforce them.

The hearth is laid without mortar or glue, this is to give the bricks and refractory tiles the ability to move with expansion and contraction.



Hearth set out on newly built base.

The glue that is readily available from refractory suppliers was used to glue the skirt into place.

Once the hearth has been laid down and the skirt in position the brickwork sides have to be built up to take the sand dome.

Dome

Sand Form.

To make the oven dome a sand form is first made on the hearth, smooth off the form until you have the desired shape ready to take the refractory concrete.
Sand dome formed and ready for the castable concrete to be applied.
The wire brick ties protruding from the brickwork were embeded into the refractory concrete to bind it all together and add strength.

Forming the sand dome.

Applying Refractory Concrete.

First coat of castable refractory concrete going over the sand form.

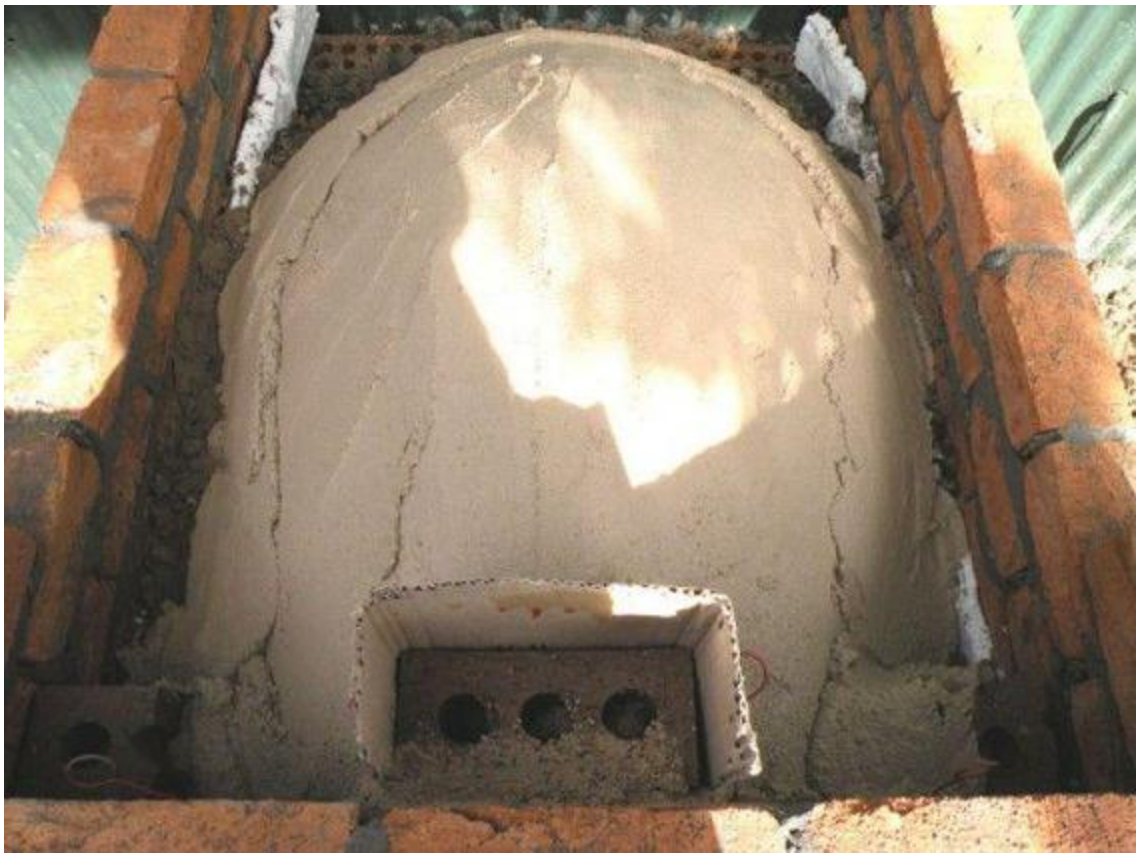
First layer of refractory concrete.

Flue opening formed with a loose brick surrounded with cardboard, the cardboard enables easy removal of the brick when the castable refractory concrete has gone off.

Second coat of castable going on.

Three coats each 20mm thick was applied.

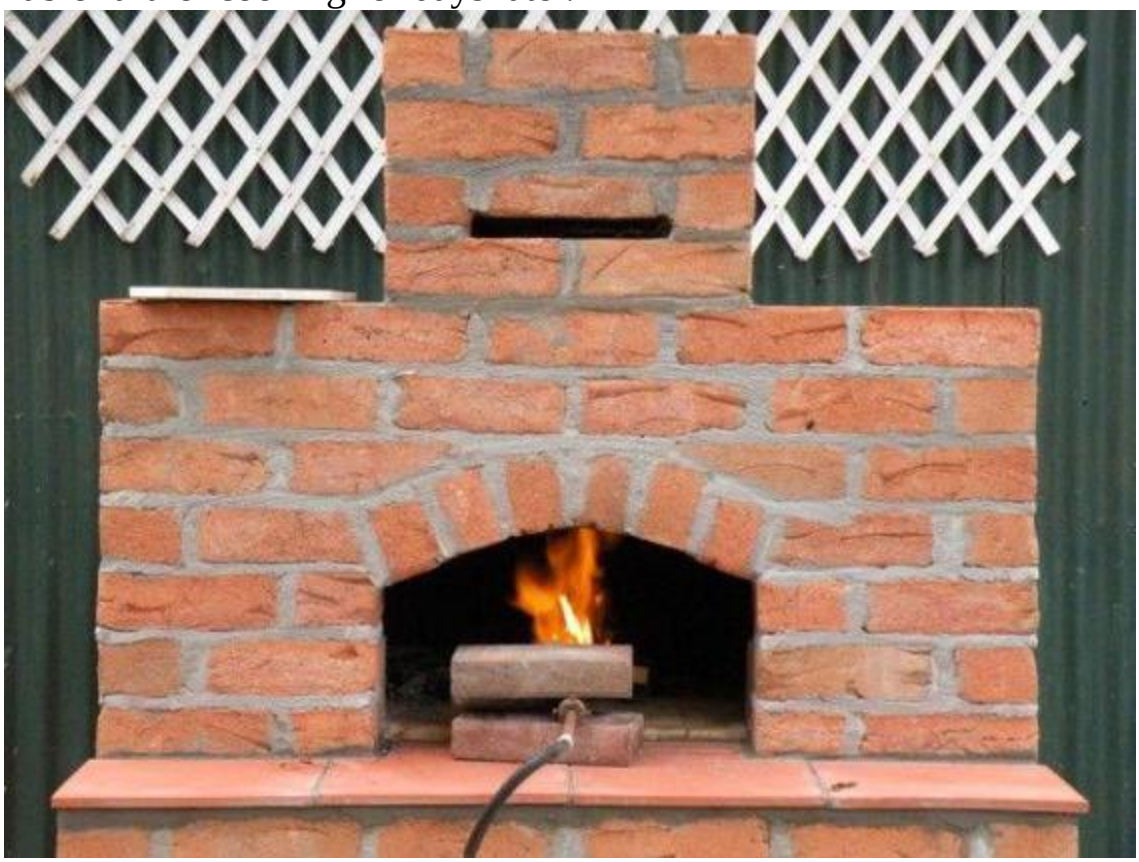
Fire proof ceramic blanket can also be seen in the picture acting as an expansion buffer between the oven skirt and the outer brickwork.



Second layer of refractory concrete.

Flue and Damper.

The flue is constructed six to eight courses higher than the oven dome, when building the flue a slot is built in to allow a damper to be inserted, the slot is as wide as the flue internally. The damper made from some kiln shelving can be closed off after the fire is out to retain the heat in the oven to enable further cooking for days later.



The flue damper is sitting on the shoulders of the oven.

Insulation.

Good high temperature insulation is a must have in order for the oven to function properly and retain the heat gained by the thermal mass.
The insulation has to be kept as dry as possible during construction as this will aid in the oven curing.
Normal house fibreglass insulation wont withstand the intense heat generated by a wood fired oven so shouldnt be used.

Ceramic Blanket.

Made from ceramic fibres spun into a blanket, can usually withstand temperatures up to 1200c
A respirator needs to be worn when handling the blanket because of the fine dust that is produced.

Ceramic Fibre.

Vermiculite.

Made from rock and expanded with heat, it can trap a great deal of heat in the oven, comes loose in 100 litre bags.
Used a lot in horticulture as it absorbs a lot of water, and as such needs a lot of drying out when the oven is in the curing stage.

Vermiculite.

Calcium Silicate Board.

High temperature rigid board that can withstand up to 1200c, size is 610 x 1000 x 40mm thick .
The board goes underneath the heart thermal mass of the hearth.

Calcium Silicate.

Applying the Insulation.

The 25mm ceramic blanket is put over the oven first.

Blanket in place.

Followed by 100mm of vermiculite mixed with portland cement and water to form a light concrete mix, the ratio of vermiculite to cement is 5 to 1, 5 parts vermiculite to 1 part of cement.

When mixed it is applied over the top of the blanket, it is crumbly in nature but will set after a few days to form a crust, it never really goes hard like concrete.

Loose Vermiculite in a wheelbarrow ready for the addition of the cement and water.

Capping.

A concrete cap is put on top of the final insulation layer to protect and waterproof the oven.

The cap was later painted to make it even more waterproof.

Curing.

This phase of oven building is critical to oven performance and longevity, cure the oven too quickly with large fires and the ovens refractories may fail.
All new ovens and ovens that haven't been used for a while will require curing, this is to drive off any moisture that will be present inside the oven.

When constructing an oven water will be introduced either via the mortar or refractory glue used. The thermal mass and insulation will also suck moisture out of the atmosphere.

A series of small controlled fires must be lit in order to drive out the moisture, having fires that are too large before the oven is fully cured could result in the oven cracking.
Curing can also be initiated with a high watt light globe that is left on inside the oven for about 7 days, the oven will still need small fires to cure but the time needed will be reduced.
A small propane burner can also be used in the same way as the light globe.

Start with very small fires of just a few twigs over the first week.
Gradually work up to a few twigs and a branch for a week.
Slowly, increase the size of the fires.
Too big an increase in fire size could make the oven fail and collapse from thermal shock.

When not cured new ovens need coaxing to get going, I use a electric heat gun.
Gradually increase the fire in size, but do it slowly.
The idea is to drive the moisture out of the oven slowly, if it is done too quickly the refractory may crack and fail.
New and wet ovens refuse to burn properly and may take weeks of constant fires to do so, the heat shouldn't be wasted though as you can still cook while learning about your new oven and the way it handles.

In this picture I used an electric heat gun after the curing fires were completed to help maintain the fire.

Oven Ready for Use.

Clear Dome.

When the oven is fired a film of carbon soot is deposited on the inside of the oven, this burns off to what is called a clear dome.

The dome clears or turns white when black carbon burns off the oven walls and ceiling as the temperature reaches 300 degrees c, this is a very good indicator of temperature and that the oven has cured.

The dome clearing after curing, you can also see the refractory dome sitting on top of the clay paver skirt.
Wet and new ovens will not get to the clear dome stage.

Fuel and oven firing.

Only good dry fuel should be used, we mainly use dried Eucalyptus but sometimes pine is used for the initial firing of the oven and then going to hardwood.
Pine spits too much when burning to be of any use for the actual cooking stage unless you like the taste of charcoal.
Wet wood will smoke lots when added to the fire so should be avoided where possible.

Any type of wood is suitable to burn with a few exceptions, any chemically treated timber or toxic tree wood shouldn't be put in the oven as the residue could contaminate the food.
Start collecting wood when you first plan on building the oven so as to have a good pile when the oven is ready to fire.
Small wrist sized and smaller is ideal wood as it gets going and releases the heat quickly, large chunks of wood are good if you want to keep the fire going for an extended period of time.

Ideal firewood for an oven.

Around 1 wheelbarrow of fuel is used to cook low temperature foods like roasts, bread etc.
Pizzas take a lot of heat and the oven needs to be fired for a few hours so it can soak the thermal mass with heat and will consume at least 3 or 4 wheelbarrow of fuel, even more if you are having friends over for a party.

Charcoal is a good wood substitute for most cooking as it burns relatively hot with no smoke and is easy and predictable to control, charcoal isn’t any good for pizza as it lacks the intense heat required.
Available from good hardware and BBQ shops.

Materials list and cost.

Materials needed to build an oven of this type, and how much will it cost.
All prices are in Australian dollars and current as of July 2011.
Bricks.
350 @ 75c = $262
Refractory tiles 300mm x 300mm x 40mm, 12@ $12 = $144
Clay pavers x 40mm, 11@ 70c = $7.70

Brickies Sand, .1/2 cubic Metre @ $58 = $29

Cement, 3 bags @ $7.50 = $22.50

Refractory concrete, 3 bags @ $40 = $120

Ceramic blanket roll 25mm thick x 7.2 Metres, 1 Roll @ $100 = $100

Calcium silicate board 610mm x 1000mm x 40mm, 2 Sheets @ $40 = $80

Vermiculite, 2 x100 litre bags @$30 = $60

Premixed Concrete,1/2 cubic Metre, this is for the foundation and the concrete for the hearth to sit on, 1/2 M3 @ $240 = $120

Kiln shelving for the damper around. $10

Terracotta Tiles,$30

Total $945

Recipes.

Basic white bread.

All mixing is done in a mixer with a dough hook, this eliminates the hand kneading process.
Multiples of the recipe can be mixed.
250 grams good quality high protein bakers flour, unbleached.
1 teaspoon dried yeast.
1 teaspoon sugar.
1/4 teaspoon salt.
1/4 teaspoon olive oil
1/2 teaspoon powdered milk.
Enough warm water to make a thick dough, 65% percent hydration is ideal.
For every 1Kg of flour add 650 ml of warm water.

Combine all dry ingredients and olive oil.
Mix in the water to make a thick dough, mix for 5 or so minutes for the gluten to start forming.
You can see the gluten form as the stings in the dough start to appear.
Let the dough rest until it doubles in size, it could take 1 hour or more, its all temperature driven.
Turn dough out of mixing bowl onto a lightly floured surface.
Stretch and fold 4 or 5 times to improve the structure of the bread.

Divide the dough up into the sizes and shapes you require and form into, buns, roll, loaf etc, putting onto an oiled tray or pan.
Let the dough sit to prove and rise some more for about another 1 hour or so.

Bake in wood fired oven at around 230 degrees C keeping an eye on it as it cooks, turning as required.

Pizza Dough.

Same as bread dough.

Food cooked in the oven.

Pizzas are not the only thing that you can cook in your new oven, we cook most of our meals in our wood fired oven.

Roast Spuds

Hot oven with clear dome.

Pizza

A digital thermometer is an ideal way of checking on how hot the oven is.

Pork Belly

Damper in to keep the oven hot.

Rogan Josh

Suppliers.

Refractory Supplies.

John Curlis will be more than happy to help you with your supplies, John is in Melbourne but can freight Australia wide.
Contact details.
Refractory Supplies, 4/8 Moncrief Rd,
Nunawading, Vic
Australia
Phone John 03 9878 8884 or 0451 470371
John@refractorysupplies.com.au

Mention that you got his details from this ebook and he will give a 10% discount off your order.

About me.

I have been a bricklayer for well over 30 years and worked on all aspects of brickwork from domestic to commercial and everything else in between.
One of my specialities is fireplace and chimney building the old fashioned way.

I first thought about building a wood fired pizza oven for my own use in February 2009 and shortly afterwards did a wood fired pizza oven workshop to learn all about the finer aspects of how they work and the construction of them.

I also run the popular brickwork web site www.bricwork.net.au
There is even a forum to ask questions and receive help with your oven build if its needed.

http://www.brickwork.net.au/cms/tikiwiki-4.3/forum2

This file was downloaded from Z-Library project

zlibrary

Your gateway to knowledge and culture. Accessible for everyone.

www

z-library.sk z-lib.gs z-lib.fm go-to-library.sk

Official Telegram channel

Z-Access

W

https://wikipedia.org/wiki/Z-Library